Manual on Codes - online

International Codes

VOLUME I.2

Part B — Binary Codes
Part C — Common Features to Binary and Alphanumeric Codes

2011 edition
Updated in 2013

World Meteorological Organization

WMO-No. 306

Weather • Climate • Water

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International Codes

Volume I.2

(Annex II to WMO Technical Regulations)

Part B – Binary Codes

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Binary and Alphanumeric Codes

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EDITORIAL NOTE

Considering that code forms, regulations, tables and notes in Volume I.2 form the basis for correct encoding/decoding, all these must be abided by regardless of the use of "shall" or "should".

Typefaces employed in this volume therefore do not signify standard or recommended practices, and are used solely for legibility.

PREFACE

Coded messages are used for the international exchange of meteorological information comprising observational data provided by the WWW Global Observing System and processed data provided by the WWW Global Data-processing and Forecasting System. Coded messages are also used for the international exchange of observed and processed data required in specific applications of meteorology to various human activities and for exchanges of information related to meteorology.

The codes are composed of a set of CODE FORMS and BINARY CODES made up of SYMBOLIC LETTERS (or groups of letters) representing meteorological or, as the case may be, other geophysical elements. In messages, these symbolic letters (or groups of letters) are transcribed into figures indicating the value or the state of the elements described. SPECIFICATIONS have been defined for the various symbolic letters to permit their transcription into figures. In some cases, the specification of the symbolic letter is sufficient to permit a direct transcription into figures. In other cases, it requires the use of CODE FIGURES, the specifications of which are given in CODE TABLES. Furthermore, a certain number of SYMBOLIC WORDS and SYMBOLIC FIGURE GROUPS have been developed for use as code names, code words, symbolic prefixes or indicator groups.

Rules concerning the selection of code forms to be exchanged *for international purposes*, and the selection of their symbolic words, figure groups and letters, are laid down in the WMO *Technical Regulations*, Volume I, Chapter A.2.3 (1988 edition). These code forms are contained in Volume I of the *Manual on Codes*, issued as Volume I.1 – Part A, and Volume I.2 – Part B and Part C.

Apart from these international codes, several sets of *regional codes* exist which are intended only for exchanges within a given WMO Region. These codes are contained in Volume II of the *Manual on Codes*. This volume also contains descriptions of:

– Regional coding procedures for the use of international code forms;

– National coding practices in the use of international or regional codes of which the Secretariat has been informed;

– National code forms.

A number of special codes which are used in messages exchanged over the WWW Global Telecommunication System circuits, and which comprise ice and satellite ephemeris codes, are included in Volume II as an Appendix.

This edition of Volume I.2 of the *Manual on Codes* replaces the 2010 edition.

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VOLUME I.2 – INTERNATIONAL CODES

INTRODUCTION

Volume I of the *Manual on Codes* contains WMO international codes for meteorological data and other geophysical data relating to meteorology; it constitutes Annex II of the WMO *Technical Regulations* and has therefore the status of a Technical Regulation. It is issued in two volumes: Volume I.1, containing PART A, and Volume I.2, containing PART B and PART C.

VOLUME I.1:

Part A – Alphanumeric Codes consists of five sections. The standard coding procedures are distinguished by the use of the term "shall" in the English text, and by suitable equivalent terms in the French, Russian and Spanish texts. Where national practices do not conform with these regulations, Members concerned shall formally notify the Secretary-General of WMO for the benefit of other Members.

VOLUME I.2:

Part B – Binary Codes consists of the list of binary codes with their specifications and associated code tables. Explanatory notes are sometimes added to regulations.

Part C – Common Features to Binary and Alphanumeric Codes consists of the list of table-driven alphanumeric codes with their specifications and associated code tables, and of common code tables to binary and alphanumeric codes.

The attachments (yellow background) to Volume I.2 do not have the status of WMO *Technical Regulations* and are given for information only.

PROCEDURES FOR AMENDING THE *MANUAL ON CODES*

1. General validation and implementation procedures

1.1 Proposal of amendments

Amendments to the *Manual on Codes* shall be proposed in writing to the WMO Secretariat. The proposal shall specify the needs, purposes and requirements for the proposed amendment. A contact point for technical matters shall be identified to facilitate collaboration for validation and drafting recommendation.

1.2 Drafting recommendation

The Inter-Programme Expert Team on Data Representation and Codes (IPET- DRMM),[1] supported by the Secretariat, shall validate the stated requirements (unless it is consequential to an amendment to the WMO Technical Regulations) and develop a draft recommendation to respond to the requirements, as appropriate.

1.3 Date of implementation

The IPET- DRMM should define a date of implementation in order to give sufficient time to WMO Members to implement the amendments after the date of notification; the IPET- DRMM should document the reasons to propose a time span of less than six months except for the fast-track procedure.

1.4 Procedures for approval

After a draft recommendation of the IPET- DRMM is validated in accordance with the procedure given in section 6 below, depending on the type of amendments, the IPET- DRMM may select one of the following procedures for the approval of the amendments:

- Fast-track procedure (see section 2 below);
- Procedure for the adoption of amendments between CBS sessions (see section 3 below);
- Procedure for the adoption of amendments during CBS sessions (see section 4 below).

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1 The IPET- DRMM, the ICT-ISS and the OPAG-ISS are the current bodies dealing with data representation and codes within CBS. If they were replaced by other bodies performing the same function, the same rules would apply, by replacing the names of the entities appropriately.

1.5 Urgent introduction

Regardless of the above procedures, as an exceptional measure, the following procedure accommodates urgent user needs to introduce new entries in BUFR/CREX tables A, B and D, code and flag tables of BUFR, CREX and GRIB edition 2 and Common Code tables.

(a) A draft recommendation developed by IPET- DRMM shall be validated according to 6.1, 6.2 and 6.3 below.

(b) The draft recommendation for pre-operational use, which can be used in operational data and products, shall be approved by the chairs of IPET- DRMM and the Open Programme Area Group on Information Systems and Services (OPAG-ISS), and the president of CBS. The list of pre-operational entries is kept on-line on the WMO Web server;

(c) Pre-operational entries need to be approved by one of the procedures in 1.4 for operational use.

1.6 Version number

The version number of the master table will be incremented.

1.7 Issuing the updated version

Once amendments to the *Manual on Codes* are adopted, an updated version of the relevant part of the Manual shall be issued in the four languages: English, French, Russian and Spanish. The Secretariat will inform all WMO Members of the availability of a new updated version of that part at the date of notification mentioned in 1.3.

2. Fast-track procedure

2.1 Scope

The fast-track procedure can be used for additions to BUFR or CREX Tables A, B, and D with associated code tables or flag tables, to code or flag tables or templates in GRIB and to common tables C.

2.2 Endorsement

Draft recommendations developed by the IPET- DRMM, including a date of implementation of the amendments, must be endorsed by the chair of OPAG-ISS.

2.3 Approval

2.3.1 Minor adjustments

The filling of reserved and unused entries in the existing code and flag tables, and Common Code tables is considered as a minor adjustment, and will be done by the Secretary-General in consultation with the president of CBS.

2.3.2 Other types of amendments

For other types of amendments, the English version of the draft recommendation, including a date of implementation, should be distributed to the focal points for codes and data representation matters for comments, with a deadline of two months for the reply. It should then be submitted to the president of CBS for adoption on behalf of the Executive Council (EC).

2.4 Frequency

The implementation of amendments approved through the fast-track procedure can be twice a year in May and November.

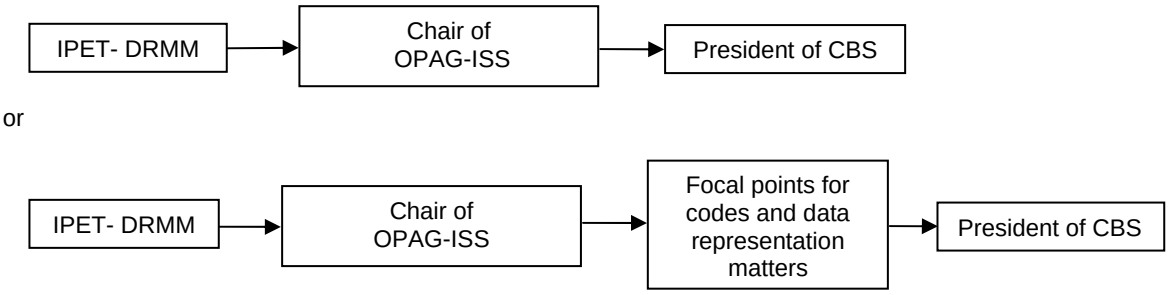

Figure 1. Adoption of amendments by fast-track procedure [changed (same as Figs 2 and 3)

3. Procedure for the adoption of amendments between CBS sessions

3.1 Approval of draft recommendation

For the direct adoption of amendments between CBS sessions, the draft recommendation developed by the IPET- DRMM, including a date of implementation of the amendments, shall be submitted to the chair of OPAG-ISS and president and vice-president of CBS for approval.

3.2 Circulation to Members

Upon approval of the president of CBS, the Secretariat sends the recommendation in the four languages (English, French, Russian and Spanish), including a date of implementation of the amendments, to all WMO Members for comments to be submitted within two months following the dispatch of the amendments.

3.3 Agreement

Those WMO Members not having replied within the two months following the dispatch of the amendments are implicitly considered as having agreed with the amendments.

3.4 Coordination

WMO Members are invited to designate a focal point responsible to discuss any comments/ disagreements with the IPET- DRMM. If the discussion between the IPET- DRMM and the focal point cannot result in an agreement on a specific amendment by a WMO Member, this amendment will be reconsidered by the IPET- DRMM.

3.5 Notification

Once amendments are agreed by WMO Members, and after consultation with the chair of the OPAG-ISS and the president and vice-president of CBS, the Secretariat notifies at the same time the WMO Members and the members of the Executive Council of the approved amendments and of the date of their implementation.

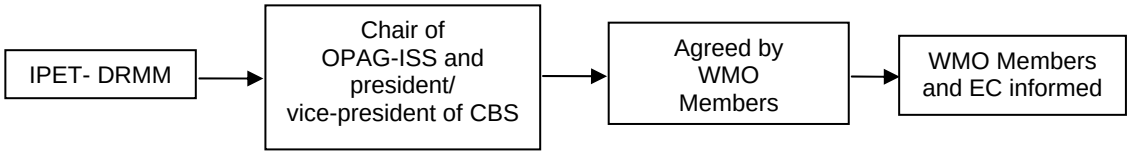

Figure 2. Adoption of amendments between CBS sessions

4. Procedure for the adoption of amendments during CBS sessions

For the adoption of amendments during CBS sessions, the IPET- DRMM submits its recommendation, including a date of implementation of the amendments, to the Implementation/Coordination Team on Information Systems and Services (ICT-ISS) of OPAG-ISS. The recommendation is then submitted to a CBS session and thereafter to an EC session.

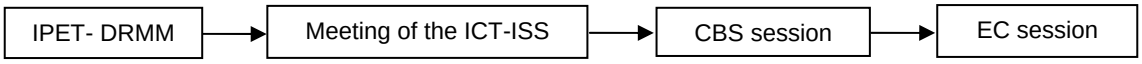

Figure 3. Adoption of amendments during a CBS session

5. Procedure for the correction of existing entries in the BUFR and CREX tables

5.1 Introducing a new descriptor

If an erroneous specification of an entry is found in an operational BUFR or CREX element descriptor or sequence descriptor, a new descriptor should preferably be added to the appropriate table through the fast-track procedure or the procedure for adoption of amendments between CBS sessions. The new descriptor should be used instead of the old one for encoding (especially if it concerns data width). An appropriate explanation shall be added to the notes of the table to clarify the practice along with the date of the change. This situation is considered a minor adjustment according to 2.3.1 above

5.2 Correcting erroneous specification

As an exceptional measure for erroneous entries in Table B, if it is found absolutely necessary to correct an erroneous specification of an existing entry by changing its specification, the following rules shall apply:

5.2.1 The name and unit of an element descriptor shall remain unchanged except for minor clarifications.

5.2.2 Scale, reference value and bit width may be corrected to required values.

5.2.3 Such a change will be submitted through the fast-track procedure.

6. Validation procedure

6.1 Documentation of need and purpose

The need for, and the purpose of, the proposal for changes should be documented.

6.2 Documentation of result

This documentation must include the results of validation testing of the proposal as described below.

6.3 Testing with encoder/decoder

For new or modified WMO code and data representation forms, proposed changes should be tested by at least two centres, using two independently developed encoders and two independently developed decoders which incorporated the proposed change. Where the data originated from a necessarily unique source (for example, the data stream from an experimental satellite), the successful testing of a single encoder with at least two independent decoders would be considered adequate. Results should be made available to the IPET-DRMM with a view to verifying the technical specifications.

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DEFINITIONS

Actual time of observation

(1) In the case of a surface synoptic observation, the time at which the barometer is read.

(2) In the case of upper-air observations, the time at which the balloon, parachute or rocket is actually released.

Alpine glow

Pink or yellow colouring assumed by mountain tops opposite the Sun when it is only just below the horizon before it rises and after it sets. This phenomenon vanishes after a brief interval of blue colouring, when the Earth's shadow reaches these summits.

Anomalous propagation

Propagation of radio energy in abnormal conditions of vertical distribution of refractive index, in association with abnormal distribution of atmospheric temperature and humidity. Use of the term is mainly confined to conditions in which abnormally large distances of propagation are attained.

Atmospheric – Sferic

Electromagnetic wave resulting from an electric discharge (lightning) in the atmosphere.

Automatic station

Meteorological station at which instruments make and transmit observations, the conversion to code form for international exchange being made either directly or at an editing station.

Aviation routine weather report

A statement of the observed meteorological conditions related to a specified time and location, issued on a routine basis for use in international air navigation.

BUFR – *Binary universal form for the representation of meteorological data*

BUFR is the name of a binary code for the exchange and storage of data.

BUFR *message*

A single complete BUFR entity.

Category

The lists of sequence descriptors tabulated in BUFR or CREX Table D are categorized according to their application; categories are provided for non-meteorological sequences, for various types of meteorological sequences, and for sequences which define reports, or major subsets of reports.

Class

A set of elements tabulated together in BUFR/CREX Table B.

Condensation trails (contrails)

Clouds which form in the wake of an aircraft when the atmosphere at flying level is sufficiently cold and humid.

Coordinate class

Classes 0–9 inclusive in BUFR/CREX Table B define elements which assist in the definition of elements from subsequent classes; each of these classes is referred to as a coordinate class.

CREX – Character form for the representation and exchange of data

CREX is the name of a table-driven alphanumeric code for the exchange and storage of data.

Data description operator

Operators which define replication or the operations listed in BUFR or CREX Table C.

Data entity

A single data item.

Data subset

A set of data corresponding to the data description in a BUFR or CREX message; for observational data, a data subset usually corresponds to one observation.

Day darkness

Sky covered with clouds with very strong optical thickness (dark clouds) having a threatening appearance.

Descriptor

An entity entered within the Data description section to describe or define data; a descriptor may take the form of an element descriptor, a replication operator, an operator descriptor, or a sequence descriptor.

Dry thunderstorm

A thunderstorm without precipitation reaching the ground (distinct from a nearby thunderstorm with precipitation reaching the ground but not at the station at the time of observation).

Dust wall or sand wall

Front of a duststorm or sandstorm, having the appearance of a gigantic high wall which moves more or less rapidly.

Element descriptor

A descriptor containing a code figure reference to BUFR/CREX Table B; the referenced entry defines an element, together with the units, scale factor, reference value and data width to be used to represent that element as data.

Equatorial regions

For the purpose of the analysis codes, the region between 30 °N and 30 °S latitudes.

Geometric altitude

Vertical distance (Z) of a level, a point or an object considered as a point, measured from mean sea level.

Geopotential

That potential with which the Earth’s gravitational field is associated. It is equivalent to the potential energy of unit mass relative to a standard level (mean sea level by convention) and is numerically equal to the work which would be done against gravity in raising the unit mass from sea level to the level at which the mass is located.

Geopotential ø at geometric height *z* is given by

$$\phi = \int_0^z g \, dz$$

where *g* is the acceleration of gravity.

Geopotential height

Height of a point in the atmosphere expressed in units (geopotential metres) proportional to the geopotential at that height. Geopotential height expressed in geopotential metres is approximately equal to $\frac{g}{9.8}$ times the geometric height expressed in (geometric) metres, *g* being the local acceleration of gravity.

Haboob

A strong wind and duststorm or sandstorm in the northern and central Sudan. Its average duration is three hours; the average maximum wind velocity is over 15 m s^{-1}. The dust or sand forms a dense whirling wall which may be 1 000 m high; it is often preceded by isolated dust whirls. Haboobs usually occur after a few days of rising temperature and falling pressure.

Ice crust (ice slick)

(1) A type of snow crust; a layer of ice, thicker than a film crust, upon a snow surface. It is formed by the freezing of melt water or rainwater which has flowed into it.

(2) See *Ice rind.*

Ice rind

A thin but hard layer of sea ice, river ice or lake ice. Apparently this term is used in at least two ways: (a) for a new encrustation upon old ice; and (b) for a single layer of ice usually found in bays and fjords where fresh water freezes on top of slightly colder sea water.

Instrumental wave data

Data on measured characteristics relating to period and height of the wave motion of the sea surface.

Inversion (layer)

Atmospheric layer, horizontal or approximately so, in which the temperature increases with increasing height.

Isothermal layer

Atmospheric layer through which there is no change of temperature with height.

Jet stream

Flat tubular current of air, quasi-horizontal, whose axis is along a line of maximum speed and which is characterized not only by great speeds but also by strong transverse gradients of speed.

Line squall

Squall which occurs along a squall line.

Lithometeor

Meteor consisting of an ensemble of particles most of which are solid and non-aqueous. The particles are more or less suspended in the air, or lifted by the wind from the ground.

Mountain waves

Oscillatory motions of the atmosphere induced by flow over a mountain; such waves are formed over and to the lee of the mountain or mountain chain.

Normals

Period averages computed for over a uniform and relatively long period comprising at least three consecutive 10-year periods.

Obscured sky

Occasions of hydrometeors or lithometeors which are so dense as to make it impossible to tell whether there is cloud above or not.

Ocean weather station

A station aboard a suitably equipped and staffed ship that endeavours to remain at a fixed sea position and that makes and reports surface and upper-air observations and may also make and report subsurface observations.

Operator descriptor

A descriptor containing a code figure reference to BUFR or CREX Table C, together with data to be used as an operand.

Past weather

Predominant characteristic of weather which had existed at the station during a given period of time.

Persistent condensation trail

Long-lived condensation trails which have spread to form clouds having the appearance of Cirrus or patches of Cirrocumulus or Cirrostratus. It is sometimes impossible to distinguish such clouds from other Cirrus, Cirrocumulus or Cirrostratus.

Present weather

Weather existing at the time of observation, or under certain conditions, during the hour preceding the time of observation.

Prevailing visibility

The greatest visibility value, observed in accordance with the definition of "visibility", which is reached within at least half the horizon circle or within at least half of the surface of the aerodrome. These areas could comprise contiguous or non-contiguous sectors.

Note: This value may be assessed by human observation and/or instrumented systems. When instruments are installed, they are used to obtain the best estimate of the prevailing visibility.

Purple light

Glow with a hue varying between pink and red, which is to be seen in the direction of the Sun before it rises and after it sets and is about 3° to 6° below the horizon. It takes the form of a segment of a more or less large luminous disc which appears above the horizon.

Reference value

All data are represented within a BUFR or CREX message by positive integers; to enable negative values to be represented, suitable negative base values are specified as reference values. The true value is obtained by addition of the reference value and the data as represented.

Replication descriptor

A special descriptor is reserved to define the replication operation; it is used to enable a given number of subsequent descriptors to be replicated a given number of times.

Runway visual range

The range over which the pilot of an aircraft on the centre line of the runway can see the runway markings or the lights delineating the runway or identifying its centre line.

Sea station

An observing station situated at sea. Sea stations include ships, ocean weather stations and stations on fixed or drifting platforms (rigs, platforms, lightships and buoys).

Section

A logical subdivision of a BUFR or CREX message, to aid description and definition.

Sequence descriptor

A descriptor used as a code figure to reference a single entry in BUFR or CREX Table D; the referenced entry contains a list of descriptors to be substituted for the sequence descriptor.

Severe line squall

Severe squall which occurs along squall line (see Line squall).

Snow haze

A suspension in the air of numerous minute snow particles, considerably reducing the visibility at the Earth's surface (visibility in snow haze often decreases to 50 m). Snow haze is observed most frequently in Arctic regions, before or after a snow storm.

Squall

Atmospheric phenomenon characterized by a very large variation of wind speed: it begins suddenly, has a duration of the order of minutes and decreases rather suddenly in speed. It is often accompanied by a shower or thunderstorm.

Squall line

Fictitious moving line, sometimes of considerable extent, along which squall phenomena occur.

Sun pillar

Pillar of white light, which may or may not be continuous, which may be observed vertically above or below the sun. Sun pillars are most frequently observed near sunrise or sunset; they may extend to about 20° above the Sun, and generally end in a point. When a sun pillar appears together with a well-developed parhelic circle, a sun cross may appear at their intersection.

Synoptic hour

Hour, expressed in terms of UTC, at which, by international agreement, meteorological observations are made simultaneously throughout the globe.

Synoptic observation

A surface or upper-air observation made at standard time.

Synoptic surface observation

Synoptic observation, other than an upper-air observation, made by an observer or an automatic weather station on the Earth's surface.

Template

Description of the standardized layout of a set of data entities.

Tropical (Tropic)

Pertaining to that region of the Earth's surface lying between the Tropic of Cancer and Tropic of Capricorn at 23° 30´N and S, respectively.

Tropical cyclone

Cyclone of tropical origin of small diameter (some hundreds of kilometres) with minimum surface pressure in some cases less than 900 hPa, very violent winds and torrential rain; sometimes accompanied by thunderstorms. It usually contains a central region, known as the "eye" of the storm, with a diameter of the order of some tens of kilometres, and with light winds and more or less lightly clouded sky.

Tropical revolving storm

Tropical cyclone.

Tropopause

(1) Upper limit of the troposphere. By convention, the "first tropopause" is defined as the lowest level at which the lapse rate decreases to 2° C km-1 or less, provided also the average lapse rate between this level and all higher levels within 2 km does not exceed 2° C km^{-1}.

(2) If, above the first tropopause, the average lapse rate between any level and all higher levels within 1 km exceeds 3° C km^{-1}, then a "second tropopause" is defined by the same criterion as under (1). This second tropopause may be either within or above the 1 km layer.

Twilight glow

See Purple light.

Twilight glow in the mountains (Alpenglühen)

See Alpine glow.

Unit of geopotential (H_m')

1 standard geopotential metre = 0.980 665 dynamic metre

$$H_m' = \frac{1}{9.80665} \int_0^z g\,(z)\,\mathrm{d}z$$

where $g(z)$ = acceleration of gravity, in m s^{-2}, as a function of geometric height;

z = geometric height, in metres;

H_m' = geopotential, in geopotential metres.

Vertical visibility

Maximum distance at which an observer can see and identify an object on the same vertical as himself, above or below.

Visibility (for aeronautical purposes)

Visibility for aeronautical purposes is the greater of:

(a) The greatest distance at which a black object of suitable dimensions, situated near the ground, can be seen and recognized when observed against a bright background;

(b) The greatest distance at which lights in the vicinity of 1000 candelas can be seen and identified against an unlit background.

Note: The two distances have different values in air of a given extinction coefficient, and the latter (b) varies with the background illumination. The former (a) is represented by the meteorological optical range (MOR).

Whiteout

Uniformly white appearance of the landscape when the ground is snow covered and the sky is uniformly covered with clouds. An atmospheric optical phenomenon of the polar regions in which the observer appears to be engulfed in a uniformly white glow. Neither shadows, horizon, nor clouds are discernible; sense of depth and orientation are lost; only very dark, nearby objects can be seen. Whiteout occurs over an unbroken snow cover and beneath a uniformly overcast sky, when, with the aid of the snowblink effect, the light from the sky is about equal to that from the snow surface. Blowing snow may be an additional cause. The phenomenon is experienced in the air as well as on the ground.

Wind (mean wind, spot wind)

Air motion relative to the Earth's surface. Unless it is otherwise specified, only the horizontal component is considered.

(1) *Mean wind:* For the purpose of upper air reports from aircraft, mean wind is derived from the drift of the aircraft when flying from one fixed point to another or obtained by flying on a circuit around a fixed observed point and an immediate wind deduced from the drift of the aircraft.

(2) *Spot wind:* For the purpose of upper-air reports from aircraft, the wind velocity, observed or predicted, for a specified location, height and time.

Zodiacal light

White or yellowish light which spreads out, in the night sky, more or less along the zodiac from the horizon on the side on which the Sun is hidden. It is observed when the sky is sufficiently dark and the atmosphere sufficiently clear.

PART B

BINARY CODES

a. FM system of numbering binary codes

b. List of binary codes with their specifications and associated code tables

FM 92-XI Ext. GRIB

FM 92 GRIB

Attachment: Definition of a triangular grid based on an icosahedron

FM 94 BUFR

Attachment: Definition of FM 94 BUFR using Backus-Naur Form

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a. FM SYSTEM OF NUMBERING BINARY CODES

Each binary code bears a number, preceded by the letters FM. This number is followed by a Roman numeral to identify the session of CBS which either approved the binary code as a new one or made the latest amendment to its previous version. A binary code approved or amended by correspondence after a session of CBS receives the number of that session.

Furthermore, an indicator term is used to designate the binary code colloquially and is therefore called a "code name".

Notes on nomenclature:

(a) Changes and augmentations to the structure of the GRIB data representation shall be identified as different "GRIB edition numbers". The current edition number is 2. However, GRIB edition 1 (FM 92-XI Ext. GRIB) remains in use and is listed in this Manual.

Changes to the content of any of the tables, including the grid definitions, shall be identified as different "table versions". Previous tables were Version 9; the version described in this edition is "Tables Version 10". Further GRIB editions and table versions may be generated independently of one another in the future as requirements dictate;

(b) Changes and augmentations to the structure of the BUFR data representation shall be identified as different "BUFR edition numbers". The previous edition number was 3. The new edition number is 4. Changes to the content of the parameter Tables A, B, C and D shall be identified as different "table versions". The previous tables were Version 20; the changes described in this edition will become "Tables A, B, C and D, Version 21".

Further BUFR editions and table versions may be generated independently of one another in the future as requirements dictate.

The FM system of numbering the binary codes, together with the corresponding code names and their reference list of CBS approved decision, is the following:

FM SYSTEM OF BINARY CODES

FM 92–XI Ext. GRIB edition 1 (gridded binary)	**Processed data in the form of grid-point values expressed in binary form** Res. 4 (EC-XXXVIII), Res. 1 (EC-XL), Rec. 23 (CBS-89), approved by the President of WMO, Rec. 22 (CBS-91), approved by the President of WMO, Rec. 15 (CBS-93), approved by the President of WMO, Rec. 16 (CBS-94), approved by the President of WMO, Res. 4 (EC-XLVII), Rec. 14 (CBS-95), approved by the President of WMO, Rec. 15 (CBS-96), approved by the President of WMO and Res. 8 (EC-LI)
FM 92–XIV GRIB	**General regularly distributed information in binary form** Res. 4 (EC-LIII), Rec. 9 (CBS-01), approved by the President of WMO, Res. 8 (EC-LV), Res. 2 (EC-LVII), Res. 10 (EC-LIX), Res. 7 (EC-LXI) and adoption between CBS sessions (2010, 2012 and 2013)

FM 94–XIV BUFR **Binary universal form for the representation of meteorological data**

Res. 1 (EC-XL), Rec. 23 (CBS-89), approved by the President of WMO, Rec. 22 (CBS-91), approved by the President of WMO, Rec. 15 (CBS-93), approved by the President of WMO, Rec. 16 (CBS-94), approved by the President of WMO, Res. 4 (EC-XLVII), Rec. 14 (CBS-95), approved by the President of WMO, Rec. 15 (CBS-96), approved by the President of WMO, Res. 4 (EC-XLIX), Rec. 9 (CBS-97), approved by the President of WMO, Rec. 10 (CBS-98), approved by the President of WMO, Res. 8 (EC-LI), Rec. 8 (CBS-99), Rec. 9 (CBS-00), approved by the President of WMO, Res. 4 (EC-LIII), Rec. 9 (CBS-01), approved by the President of WMO, Res. 8 (EC-LV), Res. 2 (EC-LVII), Res. 10 (EC-LIX), Res. 7 (EC-LXI), and adoption between CBS sessions (2010, 2012 and 2013)

b. LIST OF BINARY CODES WITH THEIR SPECIFICATIONS AND ASSOCIATED CODE TABLES

Editorial note: click following links to respective codes and attachments in separate files.

FM 92-XI Ext. GRIB edition 1 (gridded binary) — **Processed data in the form of grid-point values expressed in binary form**

FM 92-XIV GRIB — **General regularly distributed information in binary form**

Attachment: Definition of a triangular grid based on an Icosahedron

FM 94-XIV BUFR — **Binary universal form for the representation of meteorological data**

Attachment: Definition of FM 94 BUFR using Backus-Naur form

PART C

COMMON FEATURES TO BINARY AND ALPHANUMERIC CODES

a. FM system of numbering table-driven alphanumeric codes

b. List of table-driven alphanumeric codes with their specifications and associated code tables

Attachment: CREX template examples

c. Common code tables to binary and alphanumeric codes

d. Regulations for reporting traditional observation data in Table-Driven Code Forms (TDCF): BUFR or CREX

Attachment I: Examples of templates for the transmission in BUFR or CREX of other data types

Attachment II: List of alphanumeric code tables related to BUFR and CREX code tables and flag tables

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a. FM SYSTEM OF NUMBERING TABLE-DRIVEN ALPHANUMERIC CODES

Each table-driven code bears a number, preceded by the letters FM. This number is followed by a Roman numeral to identify the session of CBS which either approved the code as a new one or made the latest amendment to its previous version. A code approved or amended by correspondence after a session of CBS receives the number of that session.

Furthermore, an indicator term is used to designate the code colloquially and is therefore called a “code name”.

Note on nomenclature:

Changes and augmentations to the structure of the CREX data representation shall be identified as different “CREX edition numbers”. The previous edition number was 1. The new edition number is 2.

Changes to the content of the parameter Tables A, B, C and D shall be identified as different “table versions”. The previous tables were Version 18; the changes described in this edition will become “Tables A, B, C and D, Version 19”.

Further CREX editions and table versions may be generated independently of one another in the future as requirements dictate.

The FM system of numbering the codes, together with the corresponding code names and their reference list of CBS approved decision, is the following:

FM SYSTEM OF TABLE-DRIVEN ALPHANUMERIC CODES

FM 95–XIV CREX	**Character form for the representation and exchange of data** Res. 8 (EC-LI), Rec. 8 (CBS-99), Rec. 9 (CBS-00), approved by the President of WMO, Res. 4 (EC-LIII), Rec. 9 (CBS-01), approved by the President of WMO, Res. 2 (EC-LVII), Res. 10 (EC-LIX) and Res. 7 (EC-LXI), and adoption between CBS sessions (2010, 2012 and 2013)

b. LIST OF TABLE-DRIVEN ALPHANUMERIC CODES WITH THEIR SPECIFICATIONS AND ASSOCIATED CODE TABLES

Editorial note: click following links to respective code and attachment in separate files.

FM 95-XIV CREX	**Character form for the representation and exchange of data**

Attachment: CREX template examples

c. COMMON CODE TABLES TO BINARY AND ALPHANUMERIC CODES

Editorial note: click following links to respective Common Code table in a separate file.

COMMON CODE TABLE C–1: *Identification of originating/generating centre*

F_1F_2 for alphanumeric codes

$F_3F_3F_3$ for alphanumeric codes

Code table 0 in GRIB Edition 1/Code table 0 01 033 in BUFR Edition 3

Octet 5 in Section 1 of GRIB Edition 1/Octet 6 in Section 1 of BUFR Edition 3

COMMON CODE TABLE C–2: *Radiosonde/sounding system used*

Code table 3685 – r_ar_a (Radiosonde/sounding system used) – for alphanumeric codes

Code table 0 02 011 (Radiosonde type) in BUFR

COMMON CODE TABLE C–3: *Instrument make and type for water temperature profile measurement with fall rate equation coefficients*

Code table 1770 – $I_XI_XI_X$ (Instrument type for XBT, with fall rate equation coefficients) – for alphanumeric codes

Code table 0 22 067 (Instrument type for water temperature profile measurement) in BUFR

COMMON CODE TABLE C–4: *Water temperature profile recorder types*

Code table 4770 – X_RX_R (Recorder type) – for alphanumeric codes

Code table 0 22 068 (Water temperature profile recorder types) in BUFR

COMMON CODE TABLE C–5: *Satellite identifier*

$I_6I_6I_6$ for alphanumeric codes

Code table 0 01 007 in BUFR

Code used in GRIB Edition 2

COMMON CODE TABLE C–6: *List of units for TDCFs*

COMMON CODE TABLE C–7: *Tracking technique/status of system used*

Code table 3872 – s_as_a for alphanumeric codes

Code table 0 02 014 in BUFR

COMMON CODE TABLE C–8: *Satellite instruments*

Code table 0 02 019 in BUFR

COMMON CODE TABLE C–11: *Originating/generating centres*

BUFR 0 01 035

CREX Edition 2, ooooo in Group Pooooooppp in Section 1

GRIB Edition 2, Octets 6–7 in Section 1

BUFR Edition 4, Octets 5–6 in Section 1

COMMON CODE TABLE C–12: *Sub-centres of originating centres defined by entries in Common Code tables C–1 or C–11*

BUFR 0 01 034
BUFR Edition 3, Octet 5 in Section 1
BUFR Edition 4, Octets 7–8 in Section 1
GRIB Edition 1, Octet 26 in Section 1
GRIB Edition 2, Octets 8–9 in Section 1
CREX Edition 2, ppp in Group Pooooppp in Section 1

COMMON CODE TABLE C–13: *Data sub-categories of categories defined by entries in BUFR Table A*

BUFR Edition 4, Octet 12 in Section 1 (if = 255, it means other sub-category or undefined)
CREX Edition 2, mmm in group Annnmmm of Section 1

COMMON CODE TABLE C–14: *Atmospheric chemical or physical constituent type*

Code table 4.230 in GRIB 2

d. REGULATIONS FOR REPORTING TRADITIONAL OBSERVATION DATA IN TABLE-DRIVEN CODE FORMS (TDCF): BUFR OR CREX

The following specific regulations and their associated templates can be found on the WMO Web server at http://www.wmo.int/pages/prog/www/WMOCodes/TemplateExamples.html.

B/C1 – Regulations for reporting SYNOP data in TDCF

Annex: Regional regulations for reporting SYNOP data in BUFR/CREX for RA I, RA II, RA III, RA IV and RA VI

B/C5 – Regulations for reporting SYNOP MOBIL data in TDCF

B/C10 – Regulations for reporting SHIP data in TDCF

B/C20 – Regulations for reporting PILOT, PILOT SHIP and PILOT MOBIL data in TDCF

B/C25 – Regulations for reporting TEMP, TEMP SHIP and TEMP MOBIL data in TDCF

Annex I: RA IV BUFR template for TEMP, TEMP SHIP and TEMP MOBIL data

Annex II: List of parameters for representation of additional information on sounding instrumentation

B/C26 – Regulations for reporting TEMP DROP data in TDCF

B/C30 – Regulations for reporting CLIMAT data in TDCF

B/C32 – Regulations for reporting CLIMAT SHIP data in TDCF

General features

(i) The regulations for reporting data of traditional observations in BUFR or CREX are intended to provide a link between the Manual on Codes, Volume I.1 and Volume II, containing traditional alphanumeric codes (TAC) regulations with detailed description of reporting practices and the Volume I.2, where the code forms FM 94 BUFR and FM 95 CREX are defined.

(ii) A BUFR/CREX template has been developed for each traditional observation that is considered suitable for migration to table-driven code forms (TDCF). Templates presented prior to the regulations are BUFR templates; if used for CREX, relevant modifications have to be introduced.

(iii) The regulations for reporting data of each traditional observation in TDCF are numbered in the increasing order in compliance with a standard BUFR/CREX template recommended for the data type. For reference, the number of the corresponding TAC regulation is included at the end of the regulation, written in square brackets.

(iv) BUFR/CREX templates defined for traditional observation data contain not only the elements reported in the corresponding TAC, but also other important information. The regulations for reporting traditional observations data in BUFR/CREX address also these additional entries (e.g. horizontal and vertical coordinates of the observation site, position of sensors, significance qualifiers).

(v) With each element introduced within the regulations, the unit and the required precision are specified. If different units are used in BUFR and CREX, the unit in which the element value is reported in CREX is also mentioned. Scaling is expected to be executed by the encoding BUFR or CREX software; in case of manual encoding of a CREX message, however, the scaling shall be included in the reporting procedure.

(vi) If the unit of the element is defined as a flag table, the element values shall be reported in octal representation in CREX.

(vii) Reporting practices primarily refer to the procedures relevant for producing of the data in BUFR or CREX at the observing site. When data are collected in TAC and converted into BUFR or CREX in the centre, the differences in the reporting procedures, if any, are mentioned.

(viii) If regional or national reporting practices require inclusion of additional parameters, the regulations provide guidance for addition of the relevant descriptors.

(ix) A NIL report shall be represented by setting all values to “missing value” except for the identification of the station or observing site and delayed replication factors.

Note: Texts in italic within the regulations indicate that special attention should be given to this aspect of the regulation.

Attachment I

EXAMPLES OF TEMPLATES FOR THE TRANSMISSION IN BUFR OR CREX OF OTHER DATA TYPES

These templates, some of which have not yet been validated, can be found on the WMO Web server at http://www.wmo.int/pages/prog/www/WMOCodes/TemplateExamples.html#Attachment.

Attachment II

Editorial note: click following link to respective attachment in a separate file.

LIST OF ALPHANUMERIC CODE TABLES RELATED TO BUFR AND CREX CODE TABLES AND FLAG TABLES